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ABSTRACT

The effectiveness of a basic skills program instituted in fall 1979 at the University of New Mexico is discussed. Freshmen falling below specified American College Testing program cut-off levels were placed in developmental courses that they had to complete successfully before being eligible to enroll in freshman classes in the area of their deficiency. The social studies and natural science portions of the program are considered. The courses were designed primarily to raise students' ability to read, analyze, and evaluate social studies or natural science materials and only secondarily to enhance knowledge in a particular subject. The pre/post-test changes of students who passed a social studies or natural science basic skills course are described, with particular emphasis on students' growth in skills and content areas assessed by a standardized test. Secondly, through covariance analysis, the individual departments that taught the basic skills courses were compared to determine whether they were equally effective in raising students' skills, which was the fundamental goal of the program. (Author/SW)

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IMPACT OF A DEVELOPMENTAL PROGRAM ON STUDENT PERFORMANCE[1]

Kirk F. Minnick and Herta Teitelbaum[2]

The University of New Mexico

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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[1] Prepared for the 20th Annual Forum of the Association for Institutional Research, Atlanta, Georgia, April, 1980.

[2] Kirk Minnick is Assistant Director in the Testing Division of the University of New Mexico and Herta Teitelbaum is Assistant Dean in University College of UNM, Albuquerque, New Mexico, 87131

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Mary Corcoran
University of Minnesota
(Editor, AIR Forum Publications)

Abstract

This paper reports on the effectiveness of a Basic Skills Program instituted in Fall of 1979 at the University of New Mexico. Freshmen falling below specified ACT cut-off levels were placed in developmental courses in English, Mathematics, Social Studies, and Natural Science, which they had to complete successfully before being eligible to enroll in freshman classes in the area of their deficiency. Analysis and discussion in this paper is limited to the Social Studies and Natural Science portion of the program.

Social Studies Basic Skills courses were offered through the departments of American Studies, Anthropology, Economics, History, Political Science, Psychology, and Sociology; Natural Science Basic Skills courses were available through the Chemistry, Biology, Physics, and Geology departments. Deficient students were thus able to select a course of interest to them. It was assumed that students could be taught the processes of studying a subject matter regardless of what the course content may be. That is, the courses were designed primarily to raise students' ability to read, analyze, and evaluate Social Studies or Natural Science materials and only secondarily to enhance knowledge in a particular subject.

In the first part of the analysis, the pre/post-test changes of students who passed a Social Studies or Natural Science Basic Skills course are described, with particular emphasis on students' growth in skills and content areas assessed by a standardized test.

Secondly, through covariance analysis, the individual departments which taught the Basic Skills courses are compared to determine whether they were equally effective in raising students' skills, which was the fundamental goal of the program.

Impact of a Developmental Program on Student Performance

Introduction

Lack of adequate academic preparation on the part of entering college freshmen has been a matter of nationwide concern for some time. Many colleges, even prestigious and highly selective institutions, have found it necessary to provide developmental courses for their entering students (Roueche and Snow, 1977; Cross, 1976; Grant and Hoeber, 1978). The University of New Mexico is confronting the same problems in what may be an unusually acute form. Since 1970, readiness levels of freshmen as measured by standardized test scores, such as the ACT, have declined even more precipitously at this university than has been true either nationally or in neighboring states. Students' reading and comprehension skills have deteriorated and so has their ability to generalize and abstract. Moreover, the University of New Mexico serves an exceptionally broad range of students, each class including large numbers of Native Americans and students of Hispanic descent.

Description of Program

In an effort to remedy the deficiencies of its incoming freshmen, the University introduced a Basic Skills Program in fall of 1979, providing developmental courses in English, Mathematics, Social Studies, and Natural Sciences. The Social Studies Basic Skills courses are offered through the departments of American

Studies, Anthropology, Economics, History, Political Science, Psychology, and Sociology. The Natural Science Basic Skills component includes courses in Biology, Chemistry, Geology, and Physics. All these courses were designed to develop readiness levels for general university work. The reason that Social Studies and Natural Science Basic Skills courses were offered through several disciplines was essentially to give students an opportunity to select an area of interest to them. It was reasoned that the chosen course would serve as a vehicle to teach students the processes involved in learning a subject matter, be it Chemistry or History, by developing study skills and raising students' ability to read, comprehend, organize, and evaluate Social Studies or Natural Science materials. Acquisition of knowledge in the subject matter area itself was not a primary concern but could be an incidental outcome of the program.

A student is placed into a Basic Skills course when his or her ACT score falls below a specified level (ACT score of 18 for English, 7 for Mathematics, 13 for Social Studies, and 17 for Natural Science).[1] The English and Mathematics Basic Skills courses carry three credit hours while four credit hours are given for Social Studies and Natural Science Basic Skills courses, since the last two programs include both a lecture and a laboratory session. Basic Skills students are not permitted to enroll in a regular freshman course in the area of their deficiency unless they have successfully completed (with a C or better) the required Basic Skills course(s).

To evaluate the program's effectiveness, a pre/post-test research design was developed. The English and Mathematics Department devised their own tests for this purpose; for Social Studies and Natural Science an existing standardized test, the Sequential Test of Educational Progress (STEP) was used.

Another component of the Basic Skills Program was the creation of a Skills Center, which is located in the main library of the university. The Center was designed to assist students, through tutoring and small group sessions, in virtually any facet of their course work.

Evaluation of Program

Of the 2,608 freshmen enrolling in fall of 1979, 60% (1557 students) were required to enroll in the Basic Skills Program because their ACT scores were below the cut-off level in at least one of the areas. On the average, these freshmen were placed in two Basic Skills classes.

Obviously, a variety of measures might be used to evaluate the success of such a program. Grading patterns, ratio of student retention, and improvement in performance on standardized tests all might serve as criteria for an assessment of the program. Limits of time and space require us to focus on the last of these and to do so with particular reference to the Social Studies and Natural Science portion of the Basic Skills Program which used pre-existing standardized tests for both assignment (pre-test) and evaluation (post-test) of freshmen. However, some preliminary comments on other measures might be of interest.

The table below reports grade averages and passing rates for Basic Skills students at the close of the fall semester (Young, Minnick, & Norwood, 1980):

	BASIC SKILLS COURSE			
	English	Math.	Soc. St.	Nat. Sci.
Number of students with grades	1193	345	713	617
Average GPA	1.98	1.55	1.85	1.77
Percentage of students with grade of C or better	74%	47%	62%	63%

The passing rates vary substantially from one subject matter area to another. Three-fourths of the students successfully completed the English Basic Skills course, but less than half of the freshmen enrolled in the Basic Skills Mathematics course were able to pass. These differences are directly related to percentile ranks associated with the ACT cut-off scores used for placement. For example, students with an ACT English score of 18 and below (representing the 48th percentile rank nationally) were placed in an English Basic Skills course. The cut-off for the Basic Skills Mathematics course, in contrast, was a score of 7 or lower which encompassed only 8% of all freshmen taking the ACT nationally. It is not surprising to find quite different success rates with such diverse levels of previous achievement.

Since high attrition rates are characteristic of the academically deficient students, retention statistics are also an important component in any evaluation of Basic Skills programs. In light of the fact

that the Basic Skills Program has been in operation for one semester at this university, only retention of freshmen into the second semester can be examined at this time. A comparison was made between the 1979 fall Basic Skills students and 1978 fall freshmen who would have been placed in the Basic Skills Program based on their ACT scores had there been such a program at that time. It was found that 77.2% of the 1978 group and 80.3% of the 1979 group re-enrolled for a second semester (Young, Minnick, & Norwood, 1980). It appears that students who were exposed to a special program had a slightly higher retention rate than those who were not. However, only long-range longitudinal research will show whether the Basic Skills Program leads to a significant improvement in retention at this university.

In addition to examining retention rates, the effectiveness of Basic Skills programs is commonly evaluated in terms of academic progress made by students at the completion of the program. To determine gains made by students in the Basic Skills Program at this institution, a comparison was made between pre- and post-test information in the four subject areas. The English and Mathematics Departments developed their own pre/post measures. For students enrolled in the English Basic Skills course, an essay was used on a pre/post basis with a numerical scoring system. An improvement from an average grade of D+ to C was observed. Similarly, students who completed a Basic Skills Mathematics course were said to have improved. However, lack of equivalence between pre- and post-tests make it impossible to specify the gain associated with enrollment in this component.

Standardized tests (the STEP) were employed as pre- and post-measures in the Social Studies and the Natural Sciences component of the Basic Skills Program. These provide a firmer basis for examining improvement in both content and skill areas. The remainder of this paper will focus on an analysis of the STEP pre- and post-tests and will particularly address the following questions:

1. In which subject matter area (e.g. History, Economics, Biology) included in the STEP has there been the greatest improvement?
2. In which skill area measured by the STEP (e.g. knowledge, interpretation, evaluation) have students experienced the greatest gain?
3. Did students improve more in some Basic Skills courses in skill and content areas of the STEP than in others?

Answers to these questions will shed light on the relationship between the STEP tests and the corresponding Basic Skills courses. In addition, information in this area will be particularly useful in light of the criticism raised by some faculty that the tests did not accurately measure what was taught in the courses and the contention held by others that the results of the STEP should reflect an improvement in general readiness levels regardless of content taught in the individual Basic Skills courses.

Analysis of Social Studies and Natural Science Component of the Basic Skills Program

The Test. The Sequential Tests of Educational Progress for college freshmen and sophomores was developed by the Educational Testing Service over a decade ago as a "battery of tests designed to evaluate students' progress toward fulfilling the broad, general goals of education" (STEP Teacher's Manual, 1971, p. 9). The Social Studies portion of the STEP is comprised of 70 questions and measures three broad skill areas: capacity to organize, to interpret, and to evaluate social science information. The content of the material used in this test is taken from the fields of political science, sociology, anthropology, economics, history, and geography. The Natural Science component includes 75 items measuring knowledge and understanding of fundamental concepts and processes of science. The test items are subdivided according to four skill levels: knowledge, comprehension, application, and higher level skills of science. Subject matter for questions is drawn from the fields of biology, physics, chemistry, and earth sciences (STEP Teacher's Manual, 1971).

Reviews of the STEP by educational researchers point out that the tests may be dated in some of the content areas and in their norming information. However, there appears to be agreement that the tests adequately assess cognitive processes in the subject matter areas. While perhaps no longer adequate for purposes of

making national comparisons, the STEP is still a useful diagnostic tool (Buros, 1978).

Subjects. The students included for analysis were those who had complete test data and who had successfully finished their Basic Skills course. In order to remove a deficiency, students have to earn a C or better; those students who do not do so are required to re-enroll in a Basic Skills course in the area of their deficiency, until they receive a satisfactory grade. For Social Studies, this resulted in a narrowing of the population from 713 enrolled at the beginning of the semester to 362 students who fulfilled the requirements.[2] In Natural Science, the number of students meeting the two criteria for inclusion was 329 of the 617 initially enrolled in Basic Skills.[3]

These limitations were imposed in order to examine what success means in a Basic Skills Program. For students who received less than a C, all one can say is that the program is not yet complete. This may be true because one semester is not sufficient to remedy their deficiencies or for a variety of other reasons that may not be related to the Basic Skills Program.

Methodology. The impact of the Basic Skills Program on students' skill and content performance levels was assessed in two ways. First, pre- and post-tests were analyzed to determine whether any significant differences existed. For this purpose, correlated t-tests were computed between pre- and post-test STEP means in Social Studies and Natural Science. Only significant differences at the .01 level were reported since the probability of Type I error increases in direct proportion to the number of comparisons performed. A note of caution is appropriate here. Any improvement in students' performance can, of course, not be causally related to the effectiveness of the program, since the research design did not provide for a control group. In the absence of an experimental design, changes could have occurred irrespective of the Basic Skills program in that they may be attributable to other factors such as maturation or exposure to a novel environment.

The second stage of the analysis was concerned with the assessment of the individual Basic Skills courses' effectiveness in teaching generalizable skills. It has already been observed that each course in each Basic Skills component set out to raise general skill levels in all areas rather than merely to emphasize knowledge of the particular subdiscipline taught. If this assumption is met, it follows that successful students in any Basic Skills course would perform better on the STEP test in all subparts of the test than they did prior to course enrollment. For example, a student who passed the Basic Skills biology course should not only attain a higher score on the test questions drawing on biology information, but also on the entire Natural Science battery. Put another way, there should be no significant difference in the pre/post change attributable to the academic department from which students took their course.

It might appear that the question of existence of a "departmental effect" can be studied simply by comparing the outcomes of students who took the various courses within a field and reporting whether, for example, sociology students performed better on the STEP than students who enrolled in an economics course. However, this assessment would only be valid if we assume that students enrolled in each course were initially of equal ability levels - a proposition that cannot be established by mere comparison of test score averages and may well be untrue. Accordingly, we used an analysis of covariance to control for the relationship between pre-test and post-test scores as well as between pre-test scores and the academic departments. The adjusted post-test scores were subsequently used in a regression analysis as the dependent variable and the individual departments involved in the Basic Skills Program as the independent variables. This procedure permitted an investigation of the change between scores as a function of the courses taken rather than of initial student performance.[4]

Social Studies Basic Skills Component

Performance change from pre- to post-test. The first three tables present comparisons between pre- and post-test means, using the t-test to determine levels of significance. Table 1 gives an overview of all 362 students who passed a Basic Skills Social Studies course. The data show that, on the average, students

improved significantly in their performance on STEP test questions requiring interpretive and evaluative skills. The greatest change from pre- to post-test was observed on test items from Sociology/ Anthropology, Economics, and Geography, while gains on questions relating to Political Science and History occurred but did not reach statistical significance.

When we look at the progress on the STEP test broken down according to the Basic Skills courses in which the students enrolled, it appears that the scores of students in all but one of the classes improved. The greatest gains were noted in the following courses: Economics, Political Science, Sociology, and Psychology. Although students who completed the American Studies and Anthropology course did somewhat better on the post-test than on the pre-test, the gain was statistically not significant. Finally, students enrolled in the History class did not improve those skills that the STEP purports to assess. Possible explanations for this finding are discussed in later paragraphs.

In Tables 2 and 3, the individual Basic Skills Social Studies courses are analyzed separately. This permits a comparison of students' test performance and progress by each department. Again, pre- and post-test means as well as corresponding t-test significance levels are reported.

Changes in skill level from pre- to post-test are considered first. The data in Table 2 reveal that the individual departments vary greatly in the extent to which enrollment in their courses has led to improved skill levels.

No gain was observed in any Basic Skills course on items requiring organizational skills. Since only five questions on the whole test measured this construct explicitly, the reliability of the measure may be questionable. Economics and Psychology students significantly improved their interpretive and evaluative skills, while completion of a course in Political Science and Sociology raised students' skills in evaluation of Social Studies materials. History students, however, deviated from the general pattern in that their post-test scores were lower than the pre-test scores in two of the three skill categories.

Pre/post test comparisons of content area items are reported in Table 3. Again, this information is given separately for each department offering a Social Studies course. Contrary to expectation, improvement on content items was not strongly related to students' course of study. One would, for instance, expect to find that students who completed a Basic Skills course in History would answer correctly a substantially greater number of History questions on the post-test than on the pre-test. However, no consistent patterns are discernible in the data.

While students enrolled in Anthropology, Economics, and Political Science courses were able to answer more questions in their respective course areas correctly on the post-test than on the pre-test, the differences did not reach statistical significance. Only students who passed a Sociology course improved significantly on their answers to items related to their course of study. The performance of History students actually deteriorated on the post-test.

There may be some plausible explanations for the latter finding. It was pointed out above that the STEP has been critized because its content was developed a decade ago and has not been updated since then. The lack of a strong relationship between the content areas of the STEP and students' course of study may in part be due to the difference between content materials included in the test and the course content of the Basic Skills classes.

It may also be the case that students who enrolled in a Basic Skills History class did not change very much because students' prior knowledge of history material is generally greater than their familiarity with materials from other disciplines included in the STEP. History is a subject matter routinely taken by high school students, whereas the other subjects such as Economics or Sociology are less frequently, if at all, taught in the secondary schools. It is therefore unlikely that students have been exposed to any great extent to materials in content areas other than History. In light of these observations, it is possible that improvement is easier to detect in courses where the subject matter is relatively new to students than in a discipline with which students already have some familiarity.

Moreover, differences in test administration procedures among the departments offering Basic Skills courses may have affected the test results. For example, it is known that students in the Natural Science Basic Skills courses were told that performance

on the post-test would become part of their course grade. This approach was not followed by the History Department, which could have influenced the seriousness with which the History students took this test.

Improvement in those subparts of the test that used content material unrelated to students' course of study also varied from department to department. T-tests indicated that several of these differences were statistically significant. Economics students improved their performance in all subparts of the STEP; Psychology students maintained their initial score in Political Science, but did better in all other test areas. Political Science and Sociology students scored gains in three outside areas, but declined in one subpart. Students who completed an Anthropology course improved in two other areas, maintained the status quo in one, and lost in one area. Post-test scores of American Studies students showed an improvement in only two areas and a decline in three; finally, History students experienced gains in two outside areas, remained the same in one, and lost in one.

The reader will note that not all disciplines in which Basic Skills courses were offered are included in the STEP. Specifically, no items relating to Psychology or American Studies are incorporated in the test.

The information presented thus far would lead one to suspect that there probably are real differences among departments in the courses they offer Basic Skills students, which may have had an

effect on the extent to which students' skills have changed over the period of one semester. However, the analysis used here contains no adjustment for initial skill level differences among students enrolled in the various courses, so that these impressions remain unsubstantiated. A statistical analysis which permits us to determine whether differential gains among departments do exist is presented in the following section.

Performance change as a function of course taken. Tables 4 and 5 provide an analysis of covariance designed first to adjust for possible pre-test differences among students and then to examine whether performance differences in post-test scores are due to differences among the individual departments in which Basic Skills students were enrolled.

The analysis of the data in these tables confirms the impression that significant differences exist among the departmental Basic Skills courses. At the same time, it contradicts our initial hypothesis that student skill levels within a general area (i.e. within Social Studies) could be raised irrespective of the particular Basic Skills course in which students enroll. Moreover, the differences among the departments are significant in all skill areas and in the majority of the content areas. Whereas, for example, enrollment in an economics course was positively and significantly associated with improvement in interpretation skills, enrollment in a History course was significantly but negatively associated with improvement in that respect (Table 4).[5]

To avoid possible confusion with respect to the scope

of the analysis of covariance, it should be stressed that it does not attempt to evaluate the overall effectiveness of the Basic Skills Program, nor does it seek to determine the extent to which the program accounts for the change from pre- to post-test scores. What the analysis does is compare teaching department against teaching department to examine whether all courses are equally successful in developing those skills and areas of knowledge that are measured by the STEP.

Natural Science Basic Skills Component

Performance change from pre- to post-test. Tables 6, 7, and 8 present pre-test and post-test comparisons for the Natural Science component of the STEP test, with appropriate significance levels based on correlated t-tests. Table 6 summarizes the results for those 329 students who passed their Basic Skills Natural Science course. Significant but not uniform improvement was demonstrated in all categories. In the skills area, the gain in what is called "higher scientific ability" was least impressive, although it should be noted that only six items address that skill and questions about its reliability of measurement must be entertained. The most substantial improvement was found in the category of "application" skill. Moreover, it should be observed that students improved in all content subparts of the STEP test, with the greatest change occurring in Physics.

When test results are broken down by the Basic Skills courses in which students were enrolled, highly significant changes were found for every department. Students enrolled in Chemistry and

Geology demonstrated the largest raw score gains, with the latter posting an impressive 7% increase from pre- to post-test.

Tables 7 and 8 present, for each department offering a Natural Science Basic Skills course, pre- and post-test means. Table 7 considers changes in the skills levels between these tests, and Table 8 addresses changes in content areas measured by the test.

No particular pattern emerges from the former, although Geology students significantly improved their performance on items assessing three of the four skills tested. Biology and Chemistry students show improvement in one area. Table 8 reveals a more interesting set of relationships. Students uniformly and significantly improved their scores on those test items that related to their particular field of course study. Biology students did better on biology content questions; Chemistry students improved on items drawn from the field of chemistry; and the like. However, only Geology students improved significantly in all content areas addressed by the STEP test. While gains in areas apart from that studied in the Basic Skills course were realized for other departments as well, they did not always reach statistical significance.

Performance change as a function of course taken. Tables 9 and 10 summarize the results of the analysis of covariance for Natural Science courses. As with Tables 4 and 5, the purpose is to determine whether, when pre-test scores are controlled, significant differences exist among Natural Science Basic Skills courses in their effectiveness in raising student skill and knowledge levels.

Table 9 reveals virtually no significant differences among departments in the success of their students on the skills portion of the STEP test. This finding contrasts sharply with the data reported for Social Science courses, and comports more closely with the fundamental assumptions of the Basic Skills Program. The sole exception to the prevailing pattern is found in the relationship of Biology to application skills, where a significant negative regression coefficient exists. Apparently, that department chose to emphasize this particular skill less heavily than other Natural Science disciplines.

The same general congruity among departments is also found when test performance in the content areas are examined (Table 10). While Chemistry seems to have particularly emphasized knowledge of that area, and Biology to have focused on this and Physics content less than other Natural Science departments, the strong prevailing pattern is one of similarity in performance across course areas. In this, the experience of the Natural Science Basic Skills offerings again is consistent with the expectations generally held by the program: that students' progress should not be affected to any significant extent by the courses through which the Basic Skills are taught.

Conclusion

At the most general level, the part of the Basic Skills Program at the University of New Mexico investigated here was effective in the sense that performance of students on the post-test was, as a statistical matter, higher than on the pre-test. It should not be assumed, however, that all vehicles for teaching Basic Skills will be uniformly successful in this regard. Analysis within and across disciplines revealed significant differences in the achievement of students both between the Social Studies courses and those offered by the Natural Sciences and among participating departments within these general fields that offered Basic Skills courses.

These findings suggest that reliance on overall gain scores may not provide the most accurate measure of the potential of such programs. Where, as was true at the University of New Mexico, some courses were ineffective, overall scores will be depressed by the weakness of those courses. It is conceivable that their modification or elimination together with substitution of courses from stronger departments may lead to an even greater increase in student performance.

Footnotes

1 The cut-off scores for Social Studies and Natural Science were established by analyzing the relationship between the ACT scores and grades earned by students in previous freshman classes. The English and Mathematics minimum scores were determined by the respective teaching departments. In English, the cut-off score was decided upon in a subjective manner, while the Mathematics minimum score was arrived at on the basis of the number of students the department could serve in a Basic Skills program.

2 Of the 713 students who enrolled in a Basic Skills Social Studies course at the beginning of the semester, only 507 took both the pre- and post-test. Of these, 362 passed the course with a C or better.

3 Initially, 617 students signed up for a Natural Science Basic Skills course. However, complete test data were available on only 425 students, of whom 329 successfully completed their course work.

4 The first step in the analysis was to test for significant interactions between each covariate (skill and area pre-test scores) and the Basic Skills courses. Since no significant interactions were found, we could proceed with the analysis of covariance, using the post-test scores as the dependent variable. The relationship between the individual courses and the regressed post-test scores was assessed through the technique of effect coding the departments offering Basic Skills courses. Once the covariate has been entered into the regression equation, the dependent variable is adjusted for the pre-test performance. The adjusted post-test scores have a zero correlation with the pre-test scores and are, therefore, not biased to the extent simple gain scores tend to be. At the same time, the technique of effect coding enables the researcher to compare each course mean to the grand mean (the mean for the entire sample). Significant difference between the two means are reflected in the unstandardized regression coefficients (the B's) which can be considered reliable estimates of any differences (Cohen & Cohen, 1975).

5 Significance is based on the unstandardized regression weights reported in the "B" columns in Tables 4 and 5.

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Table 1

Pre/Post Test Comparison of Social Studies STEP Scores

		N	Pre-Test	Post-Test
Students Enrolled in Social Studies Basic Skills Courses		362	28.74	30.89*
Comparison by STEP skill area[1]				
Organization	(5)	362	2.20	2.31
Interpretation	(37)	362	16.23	17.28*
Evaluation	(28)	362	10.31	11.30*
Comparison by STEP content area[1]				
Political Science	(13)	362	4.79	4.96
Sociology/Anthropology	(15)	362	7.50	8.43*
Economics	(18)	362	6.60	7.19*
History	(15)	362	6.67	6.88
Geography	(9)	362	3.17	3.43*
Comparison by Basic Skills course				
American Studies		32	28.38	29.09
Anthropology		27	31.04	31.37
Economics		38	28.39	33.42*
History		45	28.18	28.04
Political Science		28	31.14	33.96*
Psychology		155	27.92	30.34*
Sociology		37	30.05	32.92*

[1] Numbers in parentheses refer to number of test items included in the category

* t-Test significant at $p<.01$

Table 2

Pre- and Post-Test Comparison of Students Enrolled in
Basic Skills Social Studies Courses on Cognitive Skills Assessed by STEP

Basic Skills Courses	N	STEP SKILLS					
		Organization		Interpretation		Evaluation	
		Pre	Post	Pre	Post	Pre	Post
American Studies	32	1.87	2.12	16.16	16.31	10.34	10.66
Anthropology	27	2.04	2.22	18.00	17.37	10.96	11.78
Economics	38	2.13	2.63	15.66	18.66*	10.60	12.13*
History	45	2.24	1.87	16.00	15.69	9.93	10.49
Political Science	28	2.68	2.32	17.78	19.21	10.68	12.43*
Psychology	155	2.12	2.33	15.72	17.08*	10.08	10.93*
Sociology	37	2.57	2.67	16.84	17.92	10.65	12.32*
Total	362	2.20	2.31	16.23	17.28*	10.31	11.30*

* t-Test significant at $p<.01$

Table 3

Pre- and Post-Test Comparison of Students Enrolled in
Basic Skills Social Studies Courses on Content Areas Assessed by STEP

Basic Skills Courses	N	STEP CONTENT AREAS									
		Political Science		Sociology/Anthro.		Economics		History		Geography	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
American Studies	32	4.69	4.53	7.22	8.03	6.09	6.94	6.75	6.47	3.62	3.12
Anthropology	27	5.70	5.00	7.81	8.33	7.18	7.48	7.07	7.04	3.22	3.52
Economics	38	4.66	5.60	7.21	8.76*	7.29	7.89	6.47	7.34	2.76	3.81*
History	45	4.75	4.64	7.27	7.27	6.47	6.78	6.69	6.11	3.00	3.24
Political Science	28	5.03	5.57	7.89	9.07*	7.11	7.86	7.57	7.14	3.53	4.32
Psychology	155	4.65	4.68	7.44	8.39*	6.44	7.08*	6.26	6.91*	3.12	3.27
Sociology	37	4.81	5.73	8.08	9.57*	6.35	6.92	7.54	7.27	3.27	3.43
Total	362	4.79	4.96	7.50	8.43*	6.60	7.19*	6.67	6.88	3.16	3.43*

* t-Test Significant at $p<.01$

Table 4

Analysis of Regressed Post-Test Scores
in Social Studies Skill Areas as a Function of
Basic Skills Courses (N=362)

Source	Organization			Interpretation			Evaluation		
	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B
Covariate (Pretest of Skill)	.06*	.25*	.05	.21*	.50*	.05	.13*	.41*	.05
Basic Skills Courses[1]	.05*			.08*			.05*		
American Studies		-.09	.16		-.93	.55		-.83	.47
Anthropology		-.04	.18		-.79	.60		.05	.51
Economics		.35	.15		1.66*	.52		.54	.44
History		-.45*	.14		-1.48*	.48		-.84	.41
Political Science		-.10	.17		1.16*	.59		.81	.50
Psychology		.05	.09		.05	.32		-.45	.27
Sociology		.28	.15		.33	.52		.72	.44

1 R^2 estimates are based upon the residual variance after partialing of the covariate

* $p<.01$

Table 5

Analysis of Regressed Post-Test Scores
in Social Studies Content Areas as a Function of
Basic Skills Courses (N=362)

Source	Political Science			Soc./Anthro.			Economics			History			Geography		
	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B
Covariate (Pretest of Area)	.05*	.23*	.05	.11*	.35*	.05	.23*	.49*	.05	.06	.23	.05	.10*	.32*	.05
Basic Skills Courses[1]	.05*			.07*			.01			.03			.05*		
American Studies		-.53	.30		-.35	.33		-.05	.36		-.39	.32		-.54	.24
Anthropology		-.29	.33		-.24	.36		-.03	.39		.10	.35		-.02	.25
Economics		.55	.28		.39	.31		.34	.34		.55	.30		.43	.22
History		-.43	.26		-1.13*	.29		-.39	.31		-.73*	.28		-.22	.21
Political Science		.43	.32		.47	.35		.39	.38		.09	.35		.69*	.25
Psychology		-.37	.17		-.06	.19		-.07	.21		.17	.19		-.23	.13
Sociology		.64	.29		.91*	.31		-.19	.34		.22	.31		-.12	.22

1 R^2 estimates are based upon the residual variance after the partialing of the covariate

* $p<.01$

Table 6

Pre/Post Test Comparison of Natural Science STEP Scores

		N	Pre-Test	Post-Test
Students enrolled in Natural Science Basic Skills Courses		329	30.73	34.31*
Comparison by STEP skill area[1]				
Knowledge	(13)	329	5.80	6.29*
Comprehension	(19)	329	8.70	10.04*
Application	(37)	329	13.20	14.76*
Higher Abilities	(6)	329	3.04	3.22
Comparison by STEP Content area[1]				
Biology	(30)	329	13.57	14.40*
Chemistry	(15)	329	5.14	5.94*
Physics	(19)	329	7.01	8.29*
Earth Sciences	(11)	329	5.26	5.96*
Comparison by Basic Skills Course				
Biology		114	30.72	33.42*
Chemistry		47	31.74	35.38*
Physics		52	30.54	33.27*
Geology		116	30.42	35.21*

[1] Numbers in parentheses refer to number of test items included in the category

* t-Test significant at $p<.01$

Table 7

Pre/Post Test Comparison of Students
Enrolled in Basic Skills Natural Science Courses
on Cognitive Skills Assessed by STEP

Basic Skills Course	N	STEP SKILLS							
		Knowledge		Comprehension		Application		Higher Abilities	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Biology	114	5.81	6.17	8.53	9.86*	13.34	13.95	3.07	3.44
Chemistry	47	6.08	6.47	9.34	10.40	13.17	15.40*	3.15	3.11
Physics	52	5.98	6.40	8.69	9.40	13.04	14.33	2.83	3.13
Geology	116	5.60	6.27*	8.60	10.35*	13.15	15.49*	3.07	3.09
Total	329	5.80	6.29*	8.70	10.04*	13.20	14.76*	3.04	3.22

* t-Test significant at $p<.01$

Table 8

Pre and Post-Test Comparison of Students
Enrolled in Basic Skills Natural Science Courses
on Content Areas Assessed by STEP

Basic Skills Courses	N	STEP Content Areas							
		Biology		Chemistry		Physics		Earth Sciences	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Biology	114	13.63	14.68*	5.39	5.53	6.83	7.67*	5.17	5.74
Chemistry	47	13.59	14.40	5.13	6.64*	7.79	8.77	5.51	5.98
Physics	52	13.50	14.02	4.77	5.42	7.06	8.56*	5.44	5.61
Geology	116	13.55	14.30*	5.05	6.27*	6.84	8.59*	5.18	6.33*
Total	329	13.57	14.40*	5.14	5.94*	7.01	8.29*	5.26	5.96*

* t-Test significant at $p<.01$

Table 9

Analysis of Regressed Post-Test Scores
in Natural Science Skill Areas as a Function of
Basic Skills Courses (N=329)

Source	Knowledge			Comprehension			Application			Higher Abilities		
	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B
Covariate (Pretest of Area)	.12*	.34*	.05	.08*	.31*	.06	.15*	.42*	.06	.03*	.16*	.05
Basic Skills Courses[1]	.00			.02			.05*			.02		
Biology		-.13	.16		-.07	.23		-.92*	.28		.24	.10
Chemistry		.06	.21		.23	.31		.61	.37		-.11	.14
Physics		.04	.20		-.57	.30		-.41	.36		-.03	.14
Geology		.04	.16		.41	.23		.71	.29		-.11	.10

1 R^2 estimates are based upon the Residual variance after partialing of the covariate

* $p<.01$

Table 10

Analysis of Regressed Post-Test Scores
in Natural Science Content Areas as a Function of
Basic Skills Courses (N=329)

Source	Biology			Chemistry			Physics			Earth Sciences		
	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B	R^2	B	SE_B
Covariate (Pretest of Area)	.23*	.47*	.05	.03	.21	.06	.17*	.42*	.05	.03	.17	.05
Basic Skills Courses[1]	.01			.05*			.03			.03		
Biology		.31	.24		-.50*	.18		-.61*	.22		-.14	.15
Chemistry		.39	.32		.66*	.23		.10	.29		.03	.20
Physics		-.30	.31		-.48	.23		.19	.28		-.32	.19
Geology		-.04	.24		.32	.17		.32	.21		.44*	.15

[1] R^2 estimates are based upon the Residual variance after partialing of the covariate

* $p<.01$